

semiconductor film, the plane being detected by an electron backscatter diffraction pattern method;

3% or less of the crystalline semiconductor film is the {001} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film;

5% or less of the crystalline semiconductor film is the {111} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film; and

secondary ion mass spectroscopy is conducted on the crystalline semiconductor film to reveal that the film contains less than  $5 \times 10^{18}$  nitrogen atoms per  $\text{cm}^3$ , less than  $5 \times 10^{18}$  carbon atoms per  $\text{cm}^3$ , and less than  $1 \times 10^{19}$  oxygen atoms per  $\text{cm}^3$ .

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A2 22. A semiconductor device whose pixel portion and driver circuit are formed over a same insulator, wherein:

thin film transistors in the pixel portion and in the driver circuit are all p-channel transistors;

each of the thin film transistors has a channel formation region formed of a crystalline semiconductor film that contains silicon as its main ingredient and germanium;

20% or more of the crystalline semiconductor film is the {101} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film, the plane being detected by an electron backscatter diffraction pattern method;

3% or less of the crystalline semiconductor film is the {001} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film;

5% or less of the crystalline semiconductor film is the {111} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film; and

secondary ion mass spectroscopy is conducted on the crystalline semiconductor film to reveal that the film contains less than  $5 \times 10^{18}$  nitrogen atoms per  $\text{cm}^3$ , less than  $5 \times 10^{18}$  carbon atoms per  $\text{cm}^3$ , and less than  $1 \times 10^{19}$  oxygen atoms per  $\text{cm}^3$ .

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29. A semiconductor device whose pixel portion and driver circuit are formed over a same insulator, wherein:

the driver circuit is composed of an n-channel thin film transistor and a p-channel thin film transistor;

A<sup>3</sup> each of the n-channel and p-channel thin film transistors has a channel formation region formed of a crystalline semiconductor film that contains silicon as its main ingredient and germanium;

20% or more of the crystalline semiconductor film is the {101} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film, the plane being detected by an electron backscatter diffraction pattern method;

3% or less of the crystalline semiconductor film is the {001} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film;

5% or less of the crystalline semiconductor film is the {111} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film; and

secondary ion mass spectroscopy is conducted on the crystalline semiconductor film to reveal that the film contains less than  $5 \times 10^{18}$  nitrogen atoms per  $\text{cm}^3$ , less than  $5 \times 10^{18}$  carbon atoms per  $\text{cm}^3$ , and less than  $1 \times 10^{19}$  oxygen atoms per  $\text{cm}^3$ .

A<sup>4</sup> 36. A semiconductor device whose pixel portion is formed over an insulator, wherein:  
thin film transistors in the pixel portion each have a channel formation region formed of a crystalline semiconductor film that contains silicon as its main ingredient and germanium;

20% or more of the channel formation region is the {101} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film, the plane being detected by an electron backscatter diffraction pattern method;

3% or less of the channel formation region is the {001} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film;

A4 cont.  
5% or less of the channel formation region is the {111} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film; and

secondary ion mass spectroscopy is conducted on the channel formation region to reveal that the region contains less than  $5 \times 10^{18}$  nitrogen atoms per  $\text{cm}^3$ , less than  $5 \times 10^{18}$  carbon atoms per  $\text{cm}^3$ , and less than  $1 \times 10^{19}$  oxygen atoms per  $\text{cm}^3$ .

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43. A semiconductor device whose pixel portion and driver circuit are formed over a same insulator, wherein:

the driver circuit includes a buffer composed of thin film transistors of one type of conductivity;

A5  
the buffer has a first one conductivity thin film transistor and a second one conductivity thin film transistor, the second one conductivity thin film transistor being connected to the first one conductivity thin film transistor in series and having as its gate a drain of the first one conductivity thin film transistor;

each of the first and second thin film transistors has a channel formation region formed of a crystalline semiconductor film that contains silicon as its main ingredient and germanium;

20% or more of the crystalline semiconductor film is the {101} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film, the plane being detected by an electron backscatter diffraction pattern method;

3% or less of the crystalline semiconductor film is the {001} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film;

5% or less of the crystalline semiconductor film is the {111} lattice plane that forms an angle of equal to or less than 10 degree with respect to the surface of the crystalline semiconductor film; and